

This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images,
please do not report the images to the
Image Problem Mailbox.

12

EUROPEAN PATENT APPLICATION

21 Application number: 89311940.4

51 Int. Cl.⁵: F16L 43/00, F16L 47/02,
F16L 27/00

22 Date of filing: 17.11.89

30 Priority: 13.02.89 GB 8903223

43 Date of publication of application:
22.08.90 Bulletin 90/34

64 Designated Contracting States:
AT BE CH DE ES FR GB GR IT LI LU NL SE

71 Applicant: Du Pont (UK) Limited
Hilcote Plant P.O. Box 1
Nr. Alfreton Derbyshire DE55 5JD(GB)

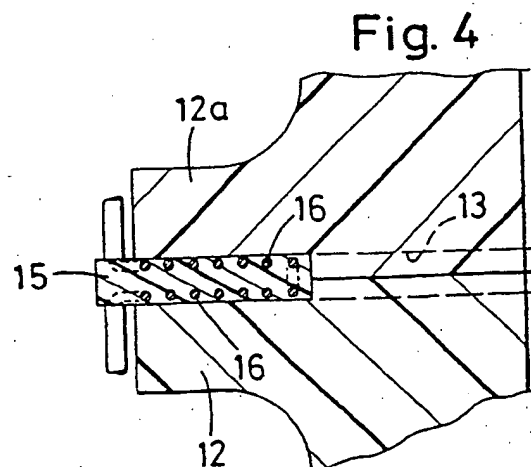
72 Inventor: Bokor, Shaun David
Chaucer House 3 Rectory Place
Wymeswold Leicestershire LE12 6UL(GB)
Inventor: Dickinson, Alan John
2 Lytham Road Ashfield Park
Kirkby-in-Ashfield Nottingham NG17
8NQ(GB)

74 Representative: Jones, Alan John et al
CARPMAELS & RANSFORD 43 Bloomsbury
Square
London, WC1A 2RA(GB)

54 Adjustable pipe bend with electrofusion facility.

57 The invention relates to an adjustable pipe bend which has at least two parts (10,10a) joined by flanges (12,12a) which incorporate an electrical fusion element in the form of a plastic annular disc (15) with a heater wire (16) located at or adjacent both surfaces of the disc (15).

A number of embodiments of the invention illustrate different adjustable bends, the arrangement being that the bend is adjusted to a required position and then the heater wire (16) has a voltage applied to it to produce a heating current which causes the plastic annular disc (15) and adjacent plastic faces of the flanges (12,12a) to melt sufficiently to cause fusion between the two parts (10,10a) of the pipe.



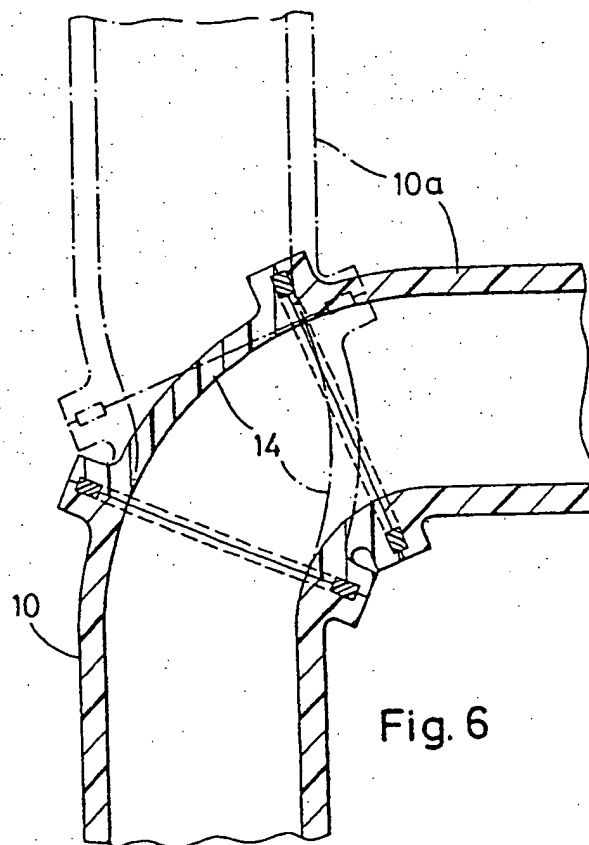


Fig. 6

Adjustable Pipe Bend with Electrofusion Facility

Pipe systems for underground gas and water distribution are assembled and fused in-situ. Changes in direction are common, minor changes can be accommodated by the inherent flexibility of the pipe, major changes are currently catered for by a range of moulded or formed fixed angle bends. The moulded or formed bends are fused into the system to maintain a consistent and fully sealed system.

One form of existing bend involves cutting two pipe ends at the same angle and fusing two such cuts together. This forms an angle that is twice the cut angle of each pipe end (i.e. a mitred joint). Bends fabricated by this angle cut and butt fuse process tend not to have good flow characteristics and they are considered not to have the same 'strength' as the pipe system from which they are formed.

In many situations the moulded fixed angle bends do not provide the appropriate degree of directional change. In this situation several bends must be assembled together or extra strain must be placed on the pipe and jointing to accommodate the change in direction. These factors make it difficult to complete the system without resorting to alternative materials which involve transitions and often non-fused elements.

An adjustable bend that could be set at the required angle and then fused would provide benefits in that it would enable fewer components to be used, it would reduce the strain on other components and it would maintain a consistent and fully fused system.

To maintain the flow properties of the pipe system it is also important that a large loss in pressure head does not occur as the fluid flows through the bend. To avoid a significant loss in pressure the adjustable bend must create a smooth change in direction and provide a consistent bore profile at whatever angle it is set.

An objective of the invention is to form an adjustable bend which may be made, for example, in medium density polyethylene (MDPE) which can be readily set to the required angle during installation, the relatively movable parts being then fusible to complete a low pressure loss bend of the required angle, which may then form part of a fully fusion sealed pipe system.

According to the present invention, there is an adjustable pipe bend comprising two relatively movable pipe parts adapted to be set at any angle to each other within a predetermined range, means being provided at the junction of the two parts to fuse the parts together when they have been set at a required angle.

Preferably the fusion means comprises an electrical heating element which is preferably located in or between mating flanges carried by the two parts.

The heating or fusion element may be in the form of a fusion element consisting of an annular ring of plastics material with a heater wire embedded in or partially embedded in one or both surfaces of the element.

Any other form of electrofusion element may be used e.g. single or double sided ring or plate, disc etc. or the electric fusion heater wire may simply be moulded into one end face of a pipe part.

Alternatively the flanges may have grooves or recesses formed in them to receive the heating element so that it is entirely contained and sealed within the flanges when they are formed together.

Optionally during fusion the flanges may be clamped e.g. with split backing rings which are spring loaded to take up fusion melt movement.

Many other plastics materials may be used in place of MDPE.

In the accompanying drawings:-

Figure 1 is a section through one component of an adjustable pipe bend embodying the present invention;

Figure 2 shows, in section, two of the components illustrated in Fig. 1 joined to form the maximum angle of bend of the system;

Figure 3 illustrates the introduction of an additional component to increase the angular range and avoid skew and offsets;

Figure 4 illustrates the use of a butt fusion element of the type shown in European Patent Appln. 87103165.4 used to fuse two components of a pipe bend embodying the present invention;

Figure 5 illustrates the complete 0° to 45° adjustable bend shown in firm line in one position and in dotted line in an adjusted position; and

Figure 6 illustrates a 0° to 90° adjustable bend, of the bend shown in Fig. 3, but again illustrating two different positions.

The concept is to have flanges set at an angle to the pipe so that when two of these flanges are rotated relative to each other a variation in angle occurs.

To obtain such a bend with the minimum number of parts and a maximum angular potential, i.e. 0 to 90 degrees from straight, the centreline axes of the pipe spigots must meet at the centre of rotation of flanges set at 45 degrees. Unfortunately if the bores of the mating parts are taken straight up to the intersect a large interfacing diameter and a sharp intersection edge are created. These ef-

fects lead to a large overall fitting diameter and a high pressure loss.

The alternative is to maintain the bore size through the fitting by creating a curve into the flange and allowing the intersect of the pipe axis to move off the centre line of flange rotation. If a two component 90 degree bend is attempted in this format the offset and skew between the spigots at intermediate angles will be very large, therefore a 45 degree maximum bend has been chosen as the base system.

The system will comprise of several PE mouldings, two of these mouldings will normally be identical in any one total bend assembly. The duplicated mouldings take the form of a pipe spigot 10 which is extended around a curve 11 and terminated in a flange 12 which forms an angle to the pipe axis as shown in Figure 1. When two such parts 10, 10a are placed flange to flange with the curve maintained as a continuous arc they form a bend whose included angle from a straight pipe is twice the change of angle of each individual component. Figure 2 shows the combined components. If the components in Figure 2 are rotated relative to each other the angular change is reduced until at 180 degrees relative movement it becomes zero, although an offset in the pipe axis remains. The skew and offset that are developed as the parts rotate relative to each other is not thought to be detrimental to the fittings performance.

The flanges 12, 12a are recessed at 13 to receive a fusion element.

It is possible, by the inclusion of another component 14 (Fig. 3) to maintain the low pressure loss curved bore of the system whilst extending the angular capability of the bend. The configuration in Figure 3 also eliminates any skew and offset provided that only the centre component 14 is rotated relative to the two outer components. A disadvantage is the extra complexity, extra components and extra fusion joints.

Where any two of the component parts meet at a flange some location must be provided so that the parts rotate about the correct axis and so that no step occurs in the smooth curve of the bore. A fusion element is also needed to provide a fully sealed system. To provide for both location and fusion a butt fusion ring is used. The location of the ring is shown in Figure 4, the ring will be of a larger size than the fittings nominal size. Details of the ring can be found in European patent No. 87103165.4 owned by Riesselmann & Sohn, but basically it consists of plastic annular disc 15 with a heater wire 16 located at or adjacent both surfaces of the disc and terminals to which wiring can be attached to supply heater current.

In Figure 5 the 0-45 degree adjustable bend, or radiused elbow, is illustrated with the bend being

shown in its extreme positions with adjustment. Portion 10a is rotated relatively to portion 10 from the firm line position shown to a dotted line position thus changing the bend angle through a 45 degree maximum.

It will be noted that in all positions the bend follows the smooth transition from part 10 to part 10a.

Figure 6 illustrates, in a similar manner, a full 0-90 degree adjustable bend using same parts 10 and 10a but with the additional centre portion 14 which enables the pipe to be adjusted for a full 90 degrees whilst again retaining smooth flow through the pipe joint in all positions. Again the extremes of adjustment shown would be parts 10a and 14 shown in their unadjusted position in firm lines and at extremes of adjustment of the parts in dotted lines.

In use, any of the adjustable bends described above may be set to a required or predetermined angle and then a voltage applied to the heater wire to produce a heating current which melts the plastic material on the surfaces of the ring, plate or disc and also melts the adjacent plastic surfaces on the pipe flanges to cause fusion of the pipe flanges to the ring, plate or disc and consequent formation of a sealed joint.

30 Claims

1. An adjustable pipe bend comprising two relatively movable pipe parts (10,10a) adapted to be set at an any angle to each other within a predetermined range characterised by means (15,16) being provided at the junction of the two parts to fuse the parts together when they have been set at a required angle.

2. A pipe end according to claim 1 and characterised in that the fusion means (15,16) comprises an electrical heating element (16).

3. A pipe end according to claim 2 in which the pipe parts are both equipped with flanges (12,12a), the flanges being adapted to mate, characterised in that the heating element (15,16) is located in or between the two mating flanges (12,12a).

4. A pipe bend according to any preceding claim characterised in that the heating or fusion element consists of an annular disc (15) of plastics material which has a heater wire (16) embedded in or partially embedded in one or both surfaces of the disc.

5. A pipe bend according to any of claims 1 to 3 characterised in that the fusion means comprises a single or double sided ring or plate, or disc embodying a heater wire.

6. A pipe bend according to claim 1 or claim 2 characterised in that the fusion means consists of

an electric fusion heater wire moulded into one end face of a pipe part.

7. A pipe bend according to claim 1 characterised in that each of the pipe parts (10,10a) is provided with a flange (12,12a) adapted to mate with the flange on the other pipe part and each flange has grooves or recesses (13) formed in a face of the flange to receive the fusion means which is in the form of a heating element, the arrangement being such that the heating element is entirely contained and sealed within the flanges when they are brought together.

8. A pipe bend according to any preceding claim characterised by means being provided to clamp the pipe parts together under spring loading during fusion to take up fusion melt movement.

9. An adjustable pipe bend according to any preceding claim characterised by having an additional pipe section (14) between the two relatively movable pipe parts so as to provide a full 90° adjustable bend.

5

10

15

20

25

30

35

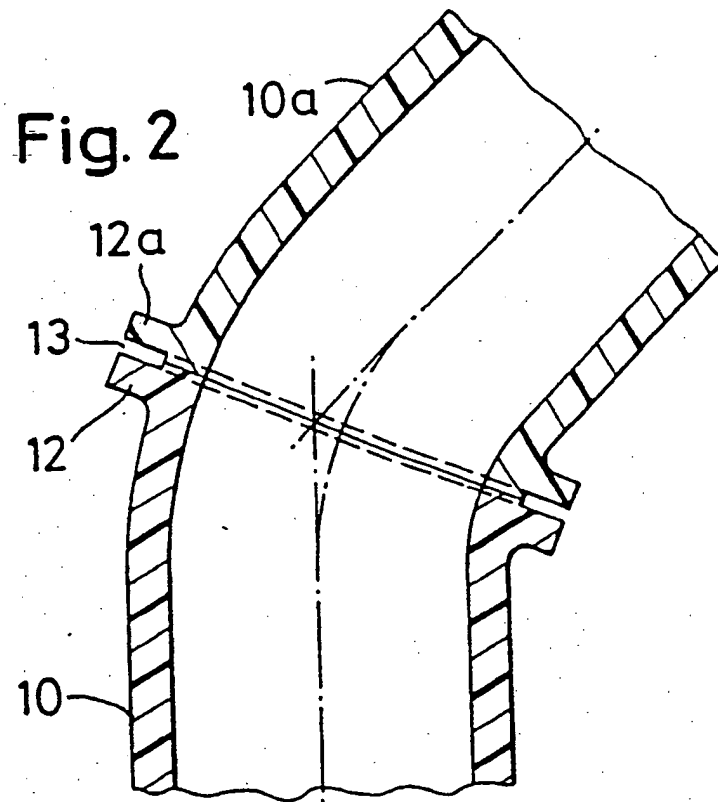
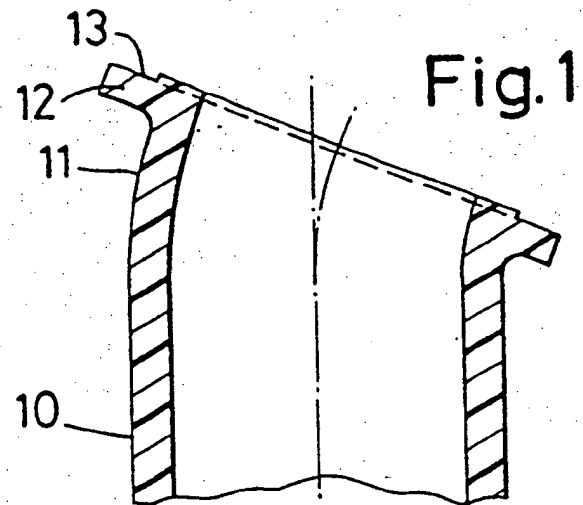
40

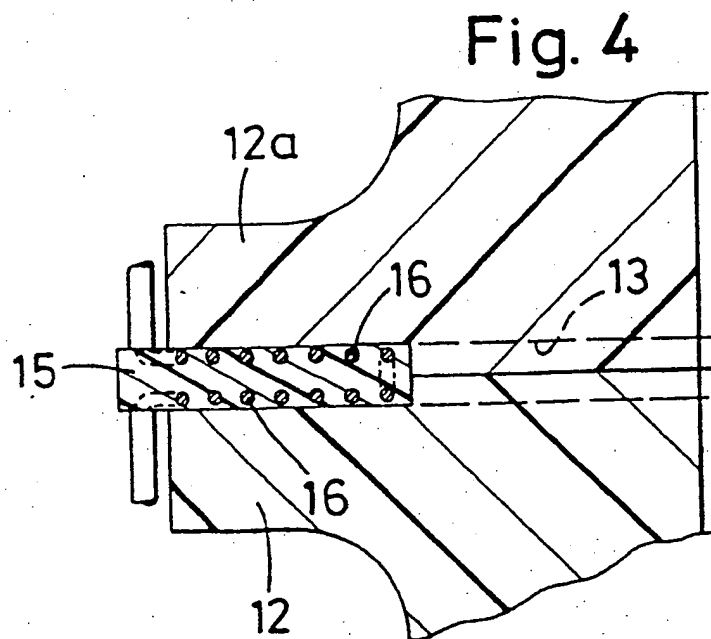
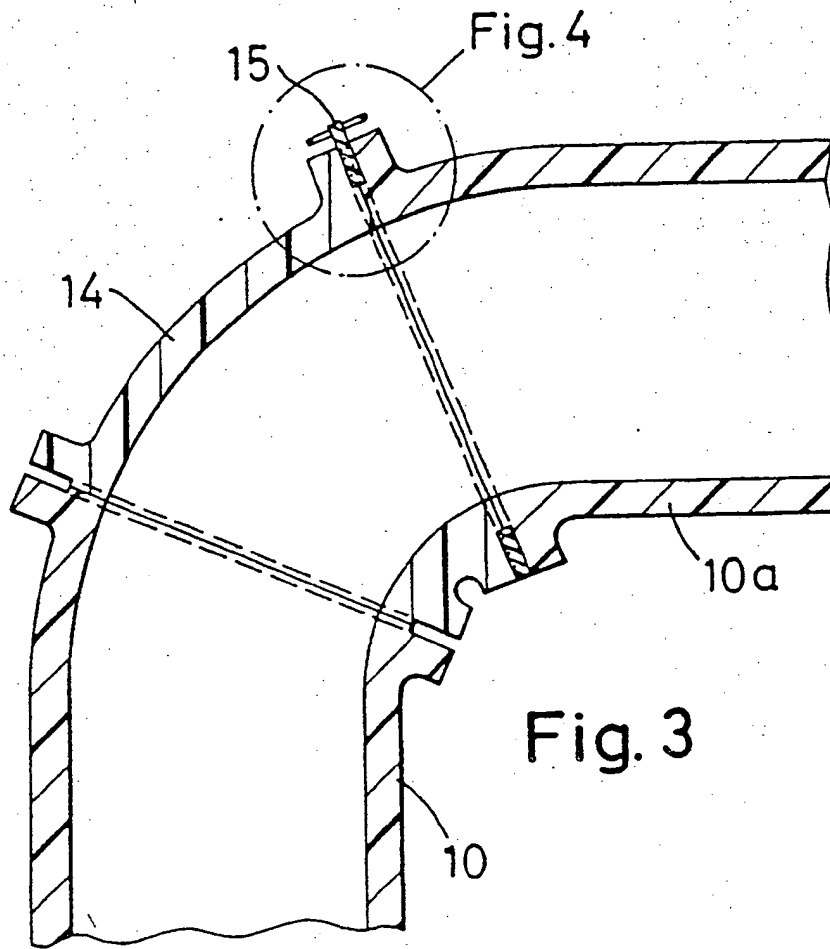
45

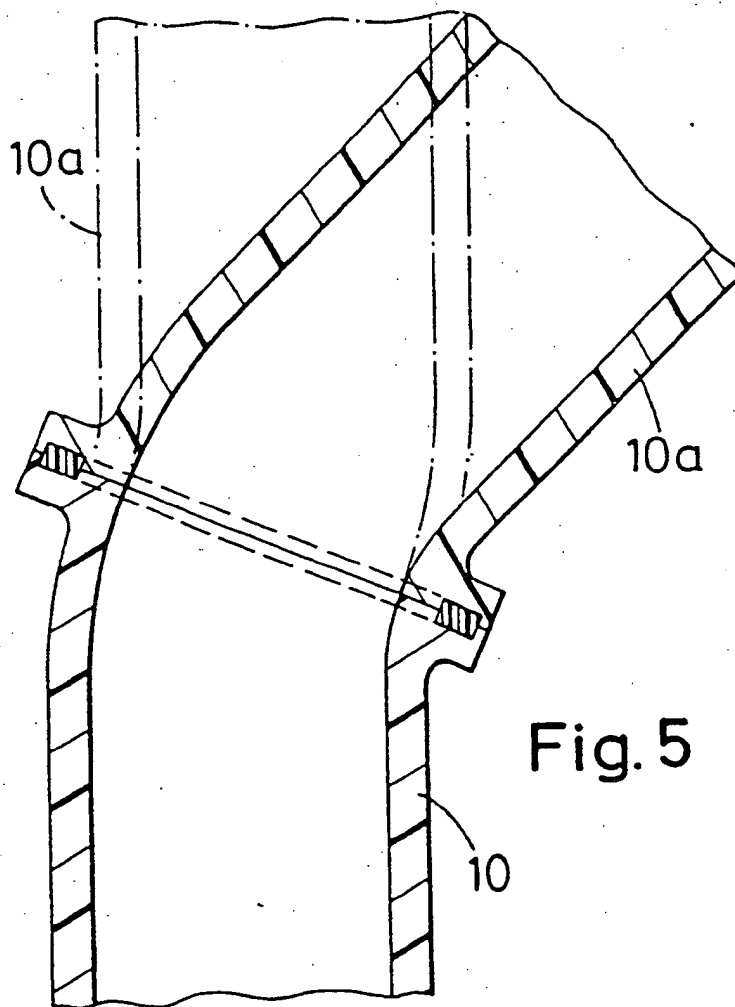
50

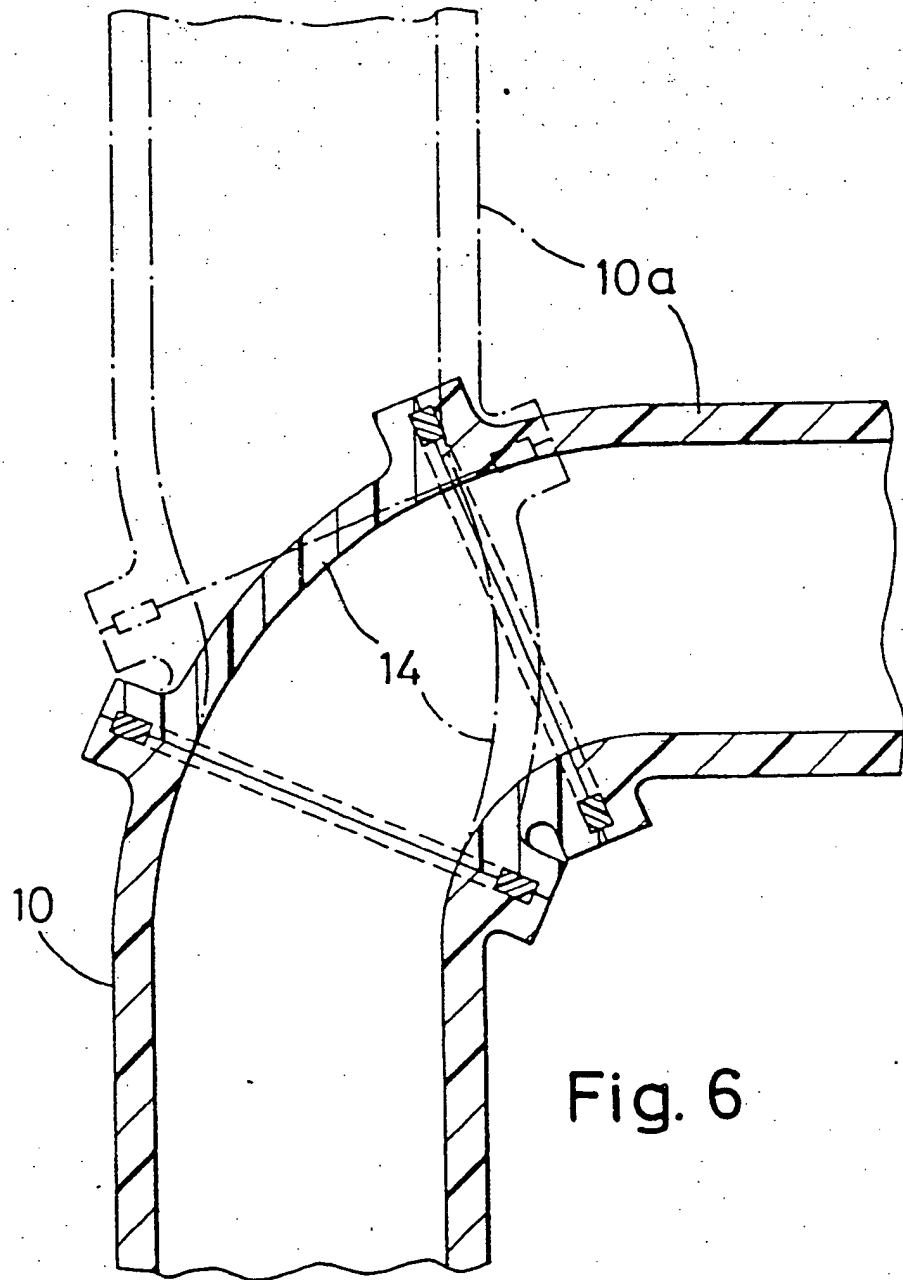
55

60











European Patent
Office

EUROPEAN SEARCH REPORT

Application number

DOCUMENTS CONSIDERED TO BE RELEVANT			EP 89311940.4
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.)
A	<u>DE - A1 - 2 641 504</u> (SALLHOFFER) * Totality *	1,7	F 16 L 43/00 F 16 L 47/02 F 16 L 27/00
A	<u>DE - A1 - 2 500 297</u> (MENICUCCI) * Totality *	1,7	
A	<u>DE - A - 2 306 642</u> (KESSEL) * Totality *	1,7	
A	<u>US - A - 4 630 846</u> (NISHINO) -----		
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int. Cl.)
			F 16 L 13/00 F 16 L 43/00 F 16 L 27/00 F 16 L 47/00
Place of search		Date of completion of the search	Examiner
VIENNA		28-02-1990	SCHUGANICH
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			